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ABSTRACT

Using data collected in 1977-78, the Evaluation System has computed fall and spring mathematics scores on the Prescriptive Mathematics Test (PMT) for classes of students in grades one through six. In addition, relationships of performance on the PMT to class size, attendance, percent of males in the class, number of different test levels used in a class, and student turnover rate in the class, have been computed. The findings are summarized in this Mini-Report. (Author/MK)

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ED182192

DISTRICT OF COLUMBIA PUBLIC SCHOOLS

THE EVALUATION SYSTEM

ACHIEVEMENT IN MATHEMATICS, 1977-1978
GRADES ONE-SIX

U S DEPARTMENT OF HEALTH, EDUCATION & WELFARE
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MINI-REPORT 79-4

VINCENT E. REED
SUPERINTENDENT OF SCHOOLS

NOVEMBER 1979

SE 030 300

DISTRICT OF COLUMBIA PUBLIC SCHOOLS

Achievement in Mathematics, 1977-1978
Grades One-Six

Mini-Report 79-4

Evaluation System
Division of Research and Evaluation
Office for Educational Accountability
November 1979

DISTRICT OF COLUMBIA PUBLIC SCHOOLS

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Preface

This is one of a series of mini-reports of the Evaluation System. The Evaluation System publishes a major report of evaluations and findings for each year of data collected. It also does a variety of background analyses and special studies of the data. Those analyses and studies are of specific technical and practical questions and issues. Whenever an analysis or a study of general interest has been completed, the Evaluation System will make the results available in this mini-report form.

Mini-reports are intended to be brief and non-technical. When they deal with technical material, the supporting analyses can be obtained from the Division of Research and Evaluation. In general, a formal technical report containing full documentation and data for the mini-series will be published periodically.

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TABLE OF CONTENTS

		Page
LIST OF TABLES		v
CHAPTER		
I	INTRODUCTION	1
II	METHOD	1
III	RESULTS AND DISCUSSION	2
IV	CONCLUSIONS	4
APPENDICES		
A.	MATHEMATICS MATERIALS SURVEY FORM 4/77	7
B.	MATHEMATICS MATERIALS SURVEY FORM 4/78	9
C.	MATHEMATICS SURVEY COMPARISON	14

LIST OF TABLES

Page

1. Mathematics Performance, 1977-1978: Percentages of Objectives Mastered by Grade 2

2. Correlation of Posttest Percentage of Objectives Mastered in Mathematics with Selected Class Characteristics by Grade 3

3. Average Number of Test Levels Per Class, by Grade ... 4

I. INTRODUCTION

Using data collected in 1977-78, the Evaluation System has computed fall and spring mathematics scores on the Prescriptive Mathematics Test (PMT) for classes of students in grades one through six. In addition, relationships of performance on the PMT to class size, attendance, percent of males in the class, test level count (number of different test levels used in a class), and student turnover rate in the class have been computed. The findings are summarized in this Mini-Report.

II. METHOD

The PMT, Levels A-F, consists of six parts:

1. Sets and numbers
2. Numeration
3. Operations and their properties
4. Problem-solving
5. Measurement
6. Geometric concepts

Each part consists of a number of test items which are grouped by objectives. Thus, each part of the PMT consists of a number of objectives to be mastered; the number, in any one part, depending on the level of the test.

Because the computer file showed that many students did not have scores for parts five and six, (Measurement and Geometric Concepts) only parts one through four were used to compute pretest (fall) and posttest (spring) scores for purposes of this report. The procedure for computing scores for the PMT was the same as that used by the Evaluation System for computing reading scores for the Prescriptive Reading Test (PRT). The individual objective was taken as the unit. For each student, the score for a particular test administration was the percentage of objectives scored as mastered according to the established criteria. That is, the student's score was the number of objectives mastered divided by the total number of objectives times 100. Since only parts one through four were used, the totalis the number of objectives for those four parts of the PMT for the test level administered.

Scores were computed only for students who were administered the same level of PMT, pre (fall) and post (spring). The students were grouped by classes, and average scores were then obtained for each class. The results reported here are thus for classes, not for individual students. For example, the average pretest percentage of objectives mastered for grade one is the average percentage based on the class means of 80 classes. The standard deviation describes the variation among the 80 class means, not among individual students. Correlation coefficients show the correlations of variables in which the class is the unit of analysis.

The primary reason for using the percentage of objectives mastered as the test score is that different students in the same classroom are often given different levels of the PMT. Since different levels have different numbers of objectives, the percentage score has been used in order to combine test levels to obtain class means.

III. RESULTS AND DISCUSSION

Table 1 shows for each grade the pretest and posttest class average percentages of mathematics objectives (for parts one through four) mastered, the standard deviations, and the pre-post average gains in percentage of objectives mastered.

It can be seen from Table 1 that the overall class average percentage of mathematics objectives mastered on pretest (Fall 1977) was 31 percent. The overall class average posttest (Spring 1978) percentage of mathematics objectives mastered was 54 percent. The overall average gain in percentage of objectives mastered from fall to spring was 23 percent. There were differences in these three characteristics from grade to grade. Generally, the final percentage of objectives mastered in the spring was greater for the primary grades than for the intermediate grades. By the same token, gains were higher in the primary grades than in the intermediate grades.

There was substantial variation in performance from class to class, as the standard deviations (SD) in Table 1 show. It can also be seen in Table 1 that there was a systematic decline in the posttest percentage of objectives mastered from grade one to grade six.

Table 1

Mathematics Performance, 1977-78
Percentage of Objectives Mastered, by Grade

	Grade						
	1	2	3	4	5	6	1-6
Number of Classes	80	91	87	78	74	76	486
Pretest Percent Objectives Mastered	26.50	38.08	35.82	30.96	28.29	26.09	31.26
SD	9.44	8.81	10.48	11.09	9.61	7.94	9.63
Posttest Percent Objectives Mastered	62.75	66.55	63.03	50.74	41.50	36.78	54.29
SD	14.85	11.26	13.17	12.62	10.78	11.06	12.39
Pre-Post Gain	36.25	28.47	27.21	19.78	13.21	10.69	23.03

Table 2 shows the correlations of posttest percentage of mathematics objectives mastered with other selected variables. It also gives the multiple R^2, which, when multiplied by 100, is the percentage of posttest variance accounted for by the six characteristics or variables listed.

Except for pretest percentage of objectives mastered, none of the class characteristics or variables analyzed showed a consistent relationship across grade levels to the percentage of posttest objectives mastered. Except for grade one, pre-post correlations for mathematics are similar to those found for reading. As Table 2 shows, there are occasional significant correlations of the variables analyzed with posttest percentage of objectives mastered. It will not be appropriate to draw conclusions about those relationships, however, unless it can be found that they also occur with the 1978-79 data. The main conclusion at this point is the one stated above: There was no systematic relationship across grades between the various class characteristics examined and posttest performance.

Table 2

Correlation of Posttest Percentage of Objectives Mastered in Mathematics with Selected Class Characteristics

Characteristic	Grade 1	2	3	4	5	6
Pretest Percentage of Math Objectives Mastered	.25*	.58**	.59**	.81**	.85**	.62**
Class Size	.11	.02	-.25*	-.01	.15	.13
Mean Class Absences (Days)	.01	-.27*	-.19	.14	.23*	.02
Percent of Males in Class	.02	.06	-.10	.08	-.02	.02
Class Holding Rate	-.08	.21*	-.04	.07	.30**	.26*
Test Level Count	.04	-.05	-.06	.27*	.11	.34**
Number of Classes	80	91	87	78	74	76
Multiple R^2	.09	.41	.39	.66	.77	.41

*p $\leq$ .05
**p $\leq$ .01

One question of interest is whether teachers used as many different levels of the PMT with their classes as they did levels of the PRT. Table 3 shows the average number of PMT and PRT levels used per class in 1977-78 in Evaluation System shcools. The averages are minimum values, since they are based only on students who were given the same level pre and post.

Table 3

Average Number of Test Levels Per Class, by Grade

	Grade						
	1	2	3	4	5	6	1-6
PMT	1.19	1.76	2.25	2.58	2.99	2.12	2.13
Number of Classes	80	91	87	78	74	76	486
PRT	1.19	1.75	2.25	2.58	2.99	2.12	2.12
Number of Classes	81	92	87	78	74	77	489

Table 3 show that the average number of different matched test levels of PMT and PRT used per class in a given grade level were essentially identical. This raises a strong suspicion that once a test level is assigned to a student it is used for both reading and mathematics testing. The diversity is minimum in both cases at the first grade level and reaches a maximum of nearly three different test levels at grade five.

IV. CONCLUSIONS

1. In 1977-78, the average percentage of mathematics objectives mastered in the fall by 486 classes, grades one through six, for parts one through four of the PMT, was 31 percent. The average percentage of objectives mastered in the spring was 54 percent. Thus, on the average, classes in the 34 Evaluation System elementary schools mastered an additional 23 percent of the total possible objectives during the year.

2. The average percentage of posttest objectives mastered in the spring was greater for grades one through three than for grades four through six. The average posttest score for the primary grades was 21 percent greater than the average posttest score for the intermediate grades, although the average pretest score of the primary grades was only 5 percent higher than the average pretest score for the intermediate grades.

3. There was much variability of performance among classes at each grade level.

4. There was no consistent relationship across grades between class average percentage of posttest objectives mastered in mathematics and: class size, mean class absences, percent males in the class, class holding rate (opposite of turnover rate), and the number of different levels of PMT used in fall and spring testing in classes.

5. A vast number of students did not do parts five and six of the PMT, therefore, those parts were not included in analyzing mathematics performance in Evaluation System schools in 1977-78. Questions raised are:

- Were these two parts omitted because they were the last given to the students after hours of testing and therefore were not done;
- Did these parts represent objectives that were not taught;
- Did students run out of time prior to completing the test; or
- Were students told not to complete the last two parts?

It is worth finding out why so many students omitted parts five (Measurement) and six (Geometric Concepts) on the PMT if they are considered essential to the overall development of mathematics skills.

APPENDIX A

EVALUATION SYSTEM

Mathematics Materials Survey

TEACHER NAME: _____ ROOM NO. _____

Please list the mathematics materials you use with your class. Return this along with your reading program forms.

Textbook	Publisher/Company
1.	
2.	
3.	
4.	
5.	

Programmed Series	Publisher/Company
1.	
2.	
3.	
4.	
5.	

Suplementary Materials	Publisher/Company
1.	
2.	
3.	
4.	
5.	

Other	Source
1.	
2.	
3.	
4.	
5.	

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APPENDIX B

EVALUATION SYSTEM School

Mathematics Materials Survey

Directions: Indicate the materials used in your building this year by placing in front of the name of the material the number of individual teachers who use the material as a major reference for their mathematics instructions.

Textbook	Publishers
___Arithmetic	- Laidlaw Brothers
___Arithmetic	- McSwain Co.
___Arithmetic Around Us	- Warp Publishing Co.
___Cambridge Work-a-Text	- Cambridge Book Co.
___Changing With Mathematics	- American Book Co.
___Discovery in Mathematics	- Laidlaw Brothers
___Discovering Mathematics	- Charles E. Merrill Books
___Elementary Mathematics	- Harcourt, Brace & World
___Elementary Mathematics Patterns & Structure	- Holt, Rinehart & Winston
___Elementary School Mathematics	- Addison-Wesley Co.
___Essential Modern Mathematics	- Ginn
___Explore Mathematics	- Cambridge Book Co.
___Exploring Elementary Mathematics	- Holt, Rinehart & Winston
___Exploring in Mathematics	- Laidlaw Brothers
___Field Mathematics Program	- Field Educational Publications, Inc.
___Fundamental Mathematics	- Milliken, Co.
___Growth in Arithmetic	- Harcourt, Brace & World
___Harbrace Mathematics	- Harcourt, Brace & Jovanovich
___Heath Elementary Mathematics	- D.C. Heath & Co.
___Holt School Mathematics	- Holt, Rinehart & Winston
___Improving With Mathematics	- American Book Co.

Textbook	Publishers
___Investigating School Mathematics	- Addison-Wesley Co.
___Learning Mathematics	- American Book Co.
___MacMillian Mathematics	- MacMillian Co.
___Mathematics	- Laidlaw Brothers
___Mathematics	- Silver Burdett Co.
___Mathematics Around Us	- Scott, Foresman & Co.
___Mathematics for Individual Achievement	- Houghton Mifflin Co.
___Modern Arithmetic Through Discovery	- Silver Burdett Co.
___Modern Mathematics	- Charles E. Merrill
___Modern Mathematics	- Hayes Publishing Co.
___Modern Mathematics Laboratory	- Deans, Kane, etc.
___Modern Mathematics Through Discovery	- Silver Burdett Co.
___Modern School Mathematics	- Houghton Mifflin Co.
___Moving Ahead in Arithmetic	- Brueckner et. al.
___Moving Ahead in Arithmetic	- Holt, Rinehart & Winston
___New Dimensions in Mathematics	- Harper & Row
___New Ways in Numbers	- D.C. Heath & Co.
___Patterns in Mathematics	- Laidlaw Bros-Doubleday Co.
___Progress in Mastering Mathematics	- William Sadlier Co.
___Progress in Mathematics	- Laidlaw Brothers
___Random House Mathematics Program	- Random House
___School Mathematics	- Lyons & Carnahan
___Spectrum Mathematics Series	- Laidlaw Brothers
___SRA-Distar Arithmetic	- Science Research Laboratory
___SRA Mathematics Learning System Text	- Science Research Associates, Inc.

Textbook	Publishers
___Target: Apply Mathematics	- American Book Co.
___Target: Meeting Mathematics	- American Book Co.
___Teaching Mathematics	- Harcourt, Brace
___Teaching Mathematics We Need	- McGraw Hill
___Thinking With Mathematics	- American Book Co.
___Understanding Mathematics	- American Book Co.
___Understanding Numbers	- Laidlaw Brothers
___Using Numbers	- Laidlaw Brothers

Programmed Series

___Borg Warner Systems 80	
___Greater Cleveland Mathematics Program	- Science Research Associates
___Individualized Mathematics System (IMS)	- Ginn
___PLAN	- Westinghouse
___SRA	- IBM
___The New Laidlaw Mathematics Program	- Laidlaw Brothers

Supplementary Materials

___Aero Learning Lab	- Aero Educational Products
___Cambridge Math Program	- Cambridge Book Co.
___Hayes Mastery Drills & Tests	- Hayes School Publishing Co., Inc.
___Individualized Computation Skills Program	- Houghton Mifflin Co.
___Individualized Computation Skills Series	- Holt, Rinehart, & Winston
___Individualized Mathematics Kit	- Random House/L.W. Singer Co.

Supplementary Materials	Publishers
___Individualized Starter Drill & Practice Kit	- Random House
___Mathematics Teaching Tape Program	- Houghton Mifflin Co.
___Math Series 400 Continuous Progress Lab	- Educational Development Lab
___Metric Kit	- Houghton Mifflin Co.
___Measure Metric & Fact Pacer	- Harcourt, Brace, Jovanovich
___Metric Measurement Program	- Science Research Associates
___Mini-Systems	- D.C. Heath
___Modern Mathematics	- Continental Press
___Orbit	- McGraw Hill
___SRA Arithmetic Kit	- Science Research Associates
___SRA Computatapes	- Science Research Associates
___SRA Mathematics Kit	- Science Research Associates
___The Metric System	- Milliken Co.
___Workbook (for Text used)	
___Workbook (Other than for Text being used)	

Other

___Cassettes

___Children made Materials

___Commercially produced materials (Games, devices, aids, etc.)

___Duplicating Masters

___Filmstrip

___Newspaper

___Records

___Tapes

___Teacher made materials

APPENDIX C

Evaluation System
Mathematics Survey Comparison
School Years 1976-77 and 1977-78

Ten Most Used Mathematics Textbooks (Ranked)

1976-77-Based on Responses from 425 Teachers in 34 Schools	1977-78-Based on Responses of Key Persons in 26 of the 34 Schools
1) Heath Elementary Mathematics (D.C. Heath & Co.)	1) Health Elementary Mathematics (D.C. Heath & Co.)
2) Investigating School Mathematics (Addison-Wesley)	2) Holt School Mathematics (Holt, Rinehart, & Winston)
3) Elementary Mathematics(Harcourt, Brace & World)	3) Mathematics Around Us (Scott, Foresman & Co.)
4) Exploring Elementary Mathematics (Holt, Rinehart, & Winston)	4) Modern School Mathematics (Houghton Mifflin Co.)
5) Holt School Mathematics (Holt, Rinehart, & Winston)	5) Exploring Elementary Mathematics (Holt, Rinehart, & Winston)
.5) Discovering Mathematics (Charles E. Merrill)	6.5) Elementary School Mathematics (Addison-Wesley Co.)
.5) Modern School Mathematics (Houghton Mifflin Co.)	6.5) Investigating School Mathematics (Addison-Wesley Co.)
8) Mathematics (Laidlaw Bros.)	8) Target Meeting Mathematics (American Book Co.)
.5) Random House Mathematics Program (Random House)	10) Harbrace Mathematics (Harcourt, Brace & Jovanovich)
.5) SRA Mathematics Learning System Text (Science Research Assoc., Inc.)	10) Elementary Mathematics (Harcourt, Brace & World)
	10) Arithmatic (Laidlaw Brothers)

The following textbooks ranked among the top ten for both years (listed alphabetically):

	1976-77	1977-78
Elementary Mathematics - Harcourt, Brace & World	3rd	10th
Exploring Elementary Mathematics - Holt, Rinehart & Winston	4th	5th
Heath Elementary Mathematics - D.C. Heath & Co.	1st	1st
Holt School Mathematics - Holt, Rinehart & Winston	5th	2nd
Investigating School Mathematics - Addison-Wesley Co.	2nd	6th
Modern School Mathematics - Houghton Mifflin Co.	6th	4th